AN ESSAY

UPON

DIABETES MELLITUS.

DIABETES MELLITUS:

AN ESSAY TO WHICH WAS AWARDED

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"THE KNOWLEDGE OF A PART IS BETTER THAN IGNORANCE OF THE WHOLE."—ARABIAN PROVERB.

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In the following Essay, the term Diabetes is used for Diabetes Mellitus throughout, to avoid pedantry. Dr. Roberts' sugar test is inserted on account of its simplicity, and the word diet is used in the most general sense of the term.

AUTHORITY.

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AN ESSAY

UPON

DIABETES MELLITUS.

PART I.

WHAT is Diabetes? Dunglison tells us that it is "a disease characterized by great augmentation and often manifest alteration in the secretion of the urine, with excessive thirst and progressive emaciation." Flint says that "the term Diabetes signifies simply an increased flow of urine, or diuresis." While Prout gives the following: "The term Diabetes implying simply an increased flow of urine, is applicable to any disease in which that symptom is present in a remarkable degree; this general use of the term, however, has caused a great deal of confusion, as a variety of diseases, differing altogether in their nature except in the accidental circumstance of being accompanied by diuresis, or a large flow of urine, have, in consequence, been confounded one with another": and to avoid confusion he says, "Hence I define Diabetes to be a disease in which the saccharine state of the urine is the characteristic symptom."

Most authors acknowledge three varieties of this disease, namely, Diabetes mellitus, Diabetes insipidus, and Diabetes chylosus. Of these varieties, Diabetes mellitus, by far the commonest of all, is known by different writers on the subject by various names, among which are Melituria, Glycosuria, Diabetes angelicus, Glucohæmia, Dyspepsia saccharigena, Saccharorrhœa urinosa and many others. Now, as little save novelty, is gained by any of these terms, and as that of Diabetes mellitus is well known and amply indicative of the disease, it seems hardly worth while to change it for an other perhaps less known and less characteristic.

Aitken thus defines Diabetes mellitus: "A constitutional disease, obviously produced through errors in the processes of assimilation, either in the stomach, in solid organs or in the blood, and characterized especially by an excessive discharge of urine more or less constantly saccharine, excessive thirst, and associated with progressive emaciation of the body." We know nothing positively as to the cause of the disease, and it seems as if it were better to leave out in the definition any theory which may be held with regard to it: acting on this principle, the following definition, though necessarily incomplete, may be passable. Diabetes mellitus is a constitutional disease, the marked symptoms of which are, an increased discharge of urine containing an abnormally large quantity of sugar, thirst and progressive emaciation.

If we go a step farther and adopt the plan of Roberts, this disease may be divided into two divisions, a temporary and a persistent class. Under the temporary class belong those cases in which the urine is saccharine but for a short period, as is often the case after traumatic injuries, mental excitement, excessive

use of amylaceous food, disturbances of the functions of the various organs, and in many other like conditions of the system.

In the second class abnormally saccharine urine is a permanent symptom, combined with thirst, emaciation and serious debility. Roberts says, "To this class alone is the term diabetes at all applicable." Still another class is embraced under the second group, "in which sugar is present in the urine, sometimes abundantly, sometimes scantily, sometimes persistently, sometimes intermittently, always with a weakly condition of health, but without thirst or conspicuous emaciation, often, indeed, with corpulence, without any, or only slight, increase in the quantity of urine, and without that fixed tendency to death which stamps the first group."

This subdivision of the second class, that of the milder type of the disease, comprises so great a variety of forms that a distinct class can hardly be recognized. It is exceedingly difficult to draw the line between the mild and serious forms of Diabetes mellitus, so closely interwoven are their symptoms. We cannot prove by any means that the persistent is but a further development of the temporary form; nor the more that if we cure a case of what seems a serious type of persistent Diabetes, that it may not be a mild type of the same affection with exaggerated symptoms.

It will perhaps render the subject clearer if we discard entirely the subdivision of the second class, and consider only the two forms of temporary and persistent Diabetes mellitus; of these the latter form — the classical Diabetes, involving as it does the health and life of the patient — is naturally the object of especial interest.

PART II.

Diabetes spares neither age nor sex, and accordingly it is detected in the child of a few months of age and in persons advanced in life. The various statistics show that the disease is one of middle age rather than of youth, and that the maximum mortality is between the ages of twenty-five and sixty-five years. If we examine still further, we shall find that the maximum mortality in females is between the ages of twenty-five and thirty-five; while that of males is between forty-five and fifty-five years. Again, the disease is more common in the male than in the female, in the proportion of three to one: it is more common, comparatively, in crowded cities than in thinly settled towns, and seems, from some reason, yet inexplicable, to abound in certain localities, and to be almost absent from others. Harley says, "It is a well-known fact that cases of Diabetes are much more common in Great Britain than on the Continent; and I, like many others, attribute this to the fact of a much greater quantity of alcoholic drinks being used among us than among European nations."

If we can judge of the prevalence of Diabetes in our own country from the statistics of a very small part of it, we should say that the disease is not a common one. In looking

over the City Registrar's reports, we find the mortality for the twelve years, 1854 to 1866,[1] to be as follows: —

YEARS.	MONTHS.																								TOTAL.
	I.		II.		III.		IV.		V.		VI.		VII.		VIII.		IX.		X.		XI.		XII.		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M	F.	
1854.																	1								1
1855.	1						1																		2
1856.																			2	1					3
1857.					1	1			2											1				1	6
1858.		2																							2
1859.				1						1													1		3
1860.				1	1		1																		3
1862.				1				2		1				1											5
1863.	1														1							1		1	4
1864.					1		1		1																3
1865.		2			1		1				1				1										6
1866.					1			1																	2

It will be seen from this table that, during these twelve years, there have been but forty deaths from Diabetes, making an average of about three deaths a year. If we consider the mortality of the months, we shall find that the late winter and early spring months have the greatest share of deaths.

There are various opinions among authors as to whether Diabetes is an hereditary disease or not. Prout thinks that the causes of the mal-assimilation of the saccharine principle are innate, and to this effect he says, "a predisposition to Diabetes is, I believe, much more frequently inherited than acquired." Roberts, on the other hand, states that "hered-

[1] There being no report for 1861.

itary influence is not a prominent predisposing cause of Diabetes."

Statistics on which we can most rely show that not a few instances are on record in which the disease has existed in several members of one family, and in families for generations. A case is recorded in which three brothers were affected with Diabetes, although the disease was not traceable to either of the parents (Rollo). By far the most marked case, however, is that reported by Sir Henry Marsh, in which Diabetes could be traced through four generations of one family. Cases in which diabetics have married and produced healthy children are reported. The instances of Diabetes in very young children would rather point to hereditary influence; but in the great majority of cases hereditary predisposition cannot be traced in the diabetic patient.

Diabetes is said to be more common among those who live in damp and wet places, and among those who have light hair, than among others.

The immediate causes of Diabetes are nearly as obscure as the remote. The advent of the disease is generally referred to some previous illness, such as low forms of fevers, cold from exposure, mental troubles, or traumatic injuries. Dr. Jordao of Lisbon, reports three cases in which Diabetes directly followed intermittent fever; and he thus explains the sequence: he thinks that the intermittent attacks are irritations of the sympathetic nerve, followed by its unavoidable paresis; during the paroxysms there is hepatic congestion, similar to that which results from paralysis of the sympathetic in physiological experiments. In intermittent fever the sympathetic is paralyzed; the same takes place in Diabetes — in

the one temporarily, in the other continuously. "Intermittent," he says, "if we may be allowed the term, is the microscopic photograph of Diabetes."[1] Cases are reported in which Diabetes was apparently induced by standing for a long time in cold water; and also those in which Diabetes occurred in sailors who were exposed to wet and cold from shipwreck. Venables thought that the acescency of the mother's or nurse's milk might give a tendency, if not actually produce, a predisposition to Diabetes.

Mental troubles are thought to be closely connected with Diabetes. "Rayer mentions a case of Diabetes coming on after a violent fit of anger, and Landouzy another after violent grief" (Roberts). Diseases of the brain, hemiplegia, apoplexy and convulsions are sometimes followed by Diabetes. The temporary variety of Diabetes is thus caused much oftener than the persistent form.

The cases in which Diabetes has appeared after traumatic injuries, such as are caused by blows, wounds, or burns are not rare. Ogle gives the case of a diabetic who, five years before the disease appeared, fell from a scaffold on which he was at work; and although not insensible at the time, had been ill ever since. Of two hundred and twenty-five cases of Diabetes, twenty are reported by Griesinger as of traumatic origin. Girdlestone reported the case of a boy who had "honey-tasted urine until dentition was completed" (Ogle). Roberts says, "it is probable that in all traumatic cases the injury (however different its seat) implicated some part of the sympathetic nervous system, either within the cranium or spinal cord, or in its peripheral distribution."

[1] *American Journal of Medical Science*, Vol. LIII., New Series.

PART III.

So stealthily does Diabetes creep upon its victims that the earliest symptoms are in most cases obscure: slight fever turns, loss of strength and general malaise, with more or less constipation, are the initial symptoms. The patient's attention is first attracted to the disease by the frequent desire to micturate; pains in the back and loins, a burning sensation in the stomach, and an extreme thirst are then noticed; the appetite, however, remains good, and the condition of the body is apparently that of health. Two cases are reported by Dr. Jordao in which epistaxis occurred in the beginning of the affection; and he refers to the hemorrhagic diathesis in Diabetes and the facility with which the blood flows from the gums, producing from a rose-colored saliva a taste of blood in the mouth, which diabetics experience on rising. Sir Henry Marsh thinks that the earliest disturbance in most cases can be traced to some derangement in the functions of the skin. However this may be, as the disease goes on, the skin becomes hard and dry, the pores being impeded so that perspiration can only be induced with difficulty.

In the next stage, as it were, of the disease, the symptoms are more characteristic; the quantity of urine discharged is now much larger than at first, in some extreme cases amounting to thirty-two pints daily; it is very light-colored and saccharine; the patient is disturbed in the night by the necessity

of micturition: from the excessive discharge of urine the urethra and its orifice often become inflamed, even producing phymosis in the male, and an intense itching about the vulva in the female.

Emaciation is now apparent, and increases day by day; the patient has an anxious and desponding look, and is peevish and irritable; the tongue becomes reddened and coated; a tenacious mucus collects in the mouth; the throat is of a dark red color, and feels dry and clammy, and the breath, in many instances, has the odor of over-ripe apples. In most cases all sexual desire becomes extinguished, neither the power nor the will remaining, and in the female the menstrual discharge is suppressed. The appetite is not inordinate at any period of the disease, but is often capricious. Œdema of the extremities is not an unfrequent symptom.

General debility, sooner or later, is invariable, and, as the disease approaches its termination, loss of memory and weakness of vision ensue. The disease may terminate by the slow exhaustion of the patient, the renal secretions becoming suppressed, coma comes on, and the patient dies in this condition; or some of the numerous complications of Diabetes, such as pulmonary troubles resembling phthisis, apoplexy, gangrene, and many others may intervene and terminate the disease.

DIÁBETIC URINE.

The urine of diabetics is generally of a light straw color, with a greenish tint. Flint states that "the urine is deficient in color in proportion to the amount of sugar which it contains." It is usually quite clear, with little if any sedi-

ment. It has a faint smell, resembling rather that of damp and mouldy straw than that of violets, new mown hay, or whey, as usually described. It is characterized by the presence of sugar in an abnormally large quantity — abnormally, for the experiments of Brücke have shown that in one thousand cubic centimeters of the urine of a healthy man, the quantity of sugar varies from 1.4 to 2.2 grains.[1] Bernard, Schiff, and Bence Jones have confirmed this result by similar experiments.

Schunck, however, found that when healthy urine was boiled with acids it gradually deposited a resinous substance, which reduced the oxide of copper; and Roberts on this account thinks that the sugar found by Brücke and others "was either partly or wholly an educt of the analysis and not a pre-existing constituent of the urine."

It is not very important in Diabetes to know whether minute quantities of sugar exist in the healthy urine or not, for in this disease sugar is always present in a sensible quantity. This diabetic sugar is chemically identical with grape sugar [C_{12} H_{12} O_{12}], and crystallizes in rhombic prisms, more or less confused. It exists in the proportion of from eight to twelve parts in one hundred, this proportion being increased by food and diminished by fasting; but even when no food at all is taken, or purely animal food only, the urine continues still saccharine, showing in the former case that the sugar is formed from the tissues themselves.

This sugar, formed from muscles and other animal tissues, called inosite [C_2 H_2 O_2], may be detected in the urine in varying quantities up to eighteen or twenty grammes per day. Aitken quotes the following: "M. Hohl records a case

[1] *Lancet*, January 19, 1861.

of Diabetes in which, while the proportion of sugar gradually diminished, the inosite gradually increased in amount, till upwards of three hundred grains were passed in the twenty-four hours."

The proportion of sugar is also diminished by the intervention of any acute disease, in which case the sugar may be altogether absent for a time.

The specific gravity of diabetic urine varies from 1.010 to 1.074; it is commonly in the vicinity of 1.035.

Before we can judge whether the quantity of urine passed by the diabetic is abnormally great in amount or not, we must know the quantity passed by the individual in a state of health. Dalton states that "the ordinary quantity of urine discharged daily by a healthy adult is about twenty-five ounces." This quantity varies from day to day, and even from hour to hour, it being largest in quantity at noon, least at night, and medium in the morning. Various causes may increase the quantity of the urine, such as over mental excitement, the use of certain drugs, and the drinking of much water. It is a well-known fact that, in the late war with the South, our soldiers were often obliged to stop to micturate just before or during an engagement, thereby undeservingly incurring the charge of cowardice.

It has been stated by Vogel that the more watery the blood the greater is the increase of the urine, and the less watery the less the increase. Towards the fatal termination of diseases, especially in febrile complaints, where the perspiration is very copious, the amount of urine is considerably diminished.

Diabetic urine may exceed thirty-two pints a day in quan-

tity; the average amount, however, is about six pints daily. The quantity of the urine is about equal to that of the liquids imbibed (Roberts). It is a curious fact that when diabetic urine is emitted upon the ground, flies and bees are attracted by it. Trousseau[1] thus mentions it: "Il avait de plus remarqué que, lors qu'il pissait dans son jardin ses urines laissaient sur le sol et sur l'herbe une trace inaccoutumée, que sur la place qu'elles avaient humectée, les abeilles venaient s'abattre, et restaient pour y puiser les sucs, qu'elles butinent ordinairement dans la corolle des fleurs."

The reaction of diabetic urine is usually feebly acid; it is, however, in some cases, neutral, and very rarely alkaline. The usual changes which take place in the constituents of diabetic urine are as follows: excess of uroxanthin, diminution of urophæin, diminution or absence of urea, chlorides normal or in excess, diminution of earthy phosphates, sulphates normal (Heller). Roberts states that "Uric acid is often difficult to detect, owing to the immense proportion of water; but it is not really absent, as has been alleged; . . . . more rarely have I seen oxalate of lime; and in one instance a persistent deposit of crystallized phosphate of lime." Albumen is not common in diabetic urine; and when it does exist it is not a favorable symptom. The old fashioned manner of detecting the sugar in the urine by taste has given way to the more agreeable and more exact tests of modern science. Those most commonly used are Trommer's, Moore's, Maumené's, and the fermentation test.

Roberts gives the following: "The best method of detecting sugar in urine is as follows: pour some of the prepared

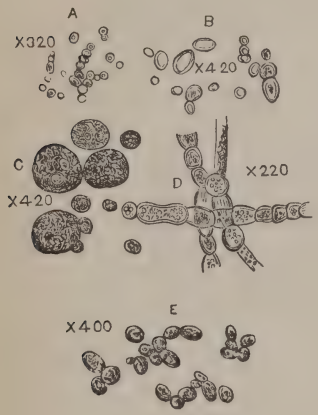
[1] *Clinique Medicale*, T. II., p. 576.

test liquor[1] into a narrow test tube, to the depth of three-quarters of an inch; heat until it begins to boil; then add two or three drops of the suspected urine. If sugar be abundant, a thick yellowish opacity and deposit of yellow sub-oxide are produced (and this changes to a brick red at once if the blue color of the test remains dominant). If no such reaction ensue, go on adding the urine until a bulk nearly equal to the test employed has been poured in; heat again to ebullition, and, no change occurring, set aside without further boiling. If no milkiness is produced as the mixture cools, the urine may be confidently pronounced free from sugar, for no quantity above a fortieth of a grain per cent. can escape such a search."

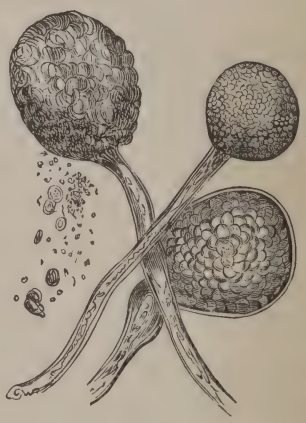
If diabetic urine be allowed to remain for a short time in a high temperature, a white scum appears just beneath the surface: if this scum is examined with the microscope, it will be found to consist of small oval confervoid vesicles, about one seventh-thousandth of an inch in diameter; these vesicles in course of time sink, form a fawn-colored stratum, become tubular in form and produce new vesicles, which branch out from the parent vesicle, forming an irregularly-jointed stem. These vesicles, the Torulæ Cerevisiæ, were first brought to notice by Dr. Hassall, who stated that this fungus was developed in specimens of diabetic urine containing even very minute traces of sugar, and that it might be regarded as characteristic of the presence of this substance, as it occurred in no other condition of the urine. The appearance of these fungi is shown in the accompanying fig-

[1] Sulphate of copper, 90.5 grains: neutral tartrate of potash, 364 grains; solution of caustic soda (Sp. gr. 1.12), 4 fluid ounces; add water to make up six fluid ounces.

ures. In Figure A, A, the fungi are represented in the sporule state; B represents a more advanced stage of the same; C, the sporules still farther advanced; D, the mycelium of the fungi; E, the manner of growth by branching. In Figure B, the method of fructification and the development of new spores are represented.[1]



A



B

Among the many immediate causes which produce sugar in the urine, for a greater or less time, are the following: the excessive use of amylaceous and saccharine foods; certain drugs in excess, such as mercury; an interference with respiration [Dr. Garrod[2] thinks that, owing to an interference of respiration, the sugar normally formed from amylaceous matter is incapable of being further changed into carbonic acid, and relates the case of a woman, subject to acute bronchitis, whose urine was found to contain sugar and albumen]; the inhalation of

[1] After Beale, Plate XXXV., Figs. 259 and 263.

[2] Transactions of Pathological Society, Vol. V.

chloroform [Pavy gives twenty cases from the operating theatre at Guy's Hospital, with the examination of the urine before and after the inhalation of chloroform, in all of which, with one exception, he found sugar after its administration, though in but four was there any trace of sugar previously]; mental exertions when extreme, and mental excitement, such as is caused by grief, anger or anxiety [from this it might seem possible that saccharine urine after the use of chloroform, might be due to mental excitement: Roberts denies that chloroform ever produces sugar in the urine]; affections of the liver and lungs; cutaneous eruptions more or less severe; traumatic injuries; indigestion [Harley states that sugar has been found in the urine after eating cheese and other ill-digested substances]; certain diseases may have a tendency to render the urine saccharine [Prout states that "a saccharine condition of the urine exists in gouty and dyspeptic individuals much oftener than is supposed"];[1] certain conditions of the system [Nebauer and Vogel state that, according to Lehmann, saccharine urine is observed in women from twenty-four to forty-eight hours after weaning]. "Raynoso and Michen state that the urine of hysterical and epileptic patients contains sugar after the attacks."[2]

In all of the above conditions the urine is but temporarily saccharine, the instances in which this saccharine condition of the urine occurs are not rare, but are not so common as is generally supposed. Ogle, who has examined the urine in a large number of patients with various diseases, has never yet found one case in which there was an appreciable amount of sugar, excluding, of course, the cases of Diabetes.

[1] This, however, is denied by Bence Jones.

[2] Ogle.

Thirst is a very common symptom of Diabetes: some patients will drink over thirty pints a day, and yet the thirst will be excessive: the presence of the sugar in the blood may explain this symptom, for it must have water to enable it to be dissolved and then eliminated from the system, and the immense amount of water taken only increases the destructive metamorphosis of tissue, and aggravates the symptoms of the disease.

The appetite is capricious throughout the disease, but toward the termination may be entirely absent, the patient even loathing food.

Emaciation is a very constant symptom: it is in proportion to the intensity and duration of the disease. Dr. Jordao speaks of the healthy and plump aspect of diabetics in the first stage of the disease; he says, "When Diabetes is chronic in its progress diabetics grow fat, and the reason of the phenomena is easily understood, for animals are fattened by giving them fæculent and sweet substances in abundance." In this same way man may be fattened by a moderate quantity of sugar in the system. During the season of the gathering of the sugar-cane, in the West Indies, the negroes grow fat by living on this substance, and although they take into the system such an abundance of sugar, Diabetes is a very rare disease among them. On this same principle of sugar fattening, many of the fairer sex, ashamed of the skeleton-like appearance which their shoulders and arms present when exposed, are in the habit of taking frequently a glass of *eau sucrée* in hopes of an amendment.

It has been ascertained that, if solids are taken into the system with an equal proportion of liquids, the disintegration

of the tissues will not go on, but that the general condition will be improved: now in Diabetes, the quantity of water taken is immense, but the defective assimilating powers of the alimentary canal prevent the absorption of an equal amount of solids; the water then only weakens the system, and emaciation is the result. Emaciation, however, is not always present. Prout mentions a case of Diabetes in which the patient weighed twenty-three stone. Roberts had a patient ill with Diabetes weighing over fifteen stone.

As to the œdema of diabetics: "Dr. Garrod states that the œdema of the legs is a constant feature in Diabetes. It is certainly very common; and the flat surfaces of the tibiæ can nearly always be made to pit on firm pressure, even when no fulness exists about the ankles. I am satisfied, however, that this pitting, when very slight, is not due to œdema, but rather to the soft atonic state of the subcutaneous tissues" (Roberts).

The digestion is generally well performed in the early stages of the affection, but after a while, owing perhaps to the intolerance of so much food as diabetics generally consume, or to the peculiar character of it, dyspepsia begins to show itself; vomiting after eating is not uncommon. The constipation in Diabetes, as in other diseases, may alternate with diarrhœa; should the diarrhœa be of a dysenteric character, it becomes "a formidable and generally speedily fatal complication." Venables says that "diarrhœa more frequently attacks diabetic children than adults."

The dryness of the skin is a very constant symptom. Sir Henry Marsh thinks that every case of Diabetes is accompanied by a morbid condition of the skin; there are

exceptions to this, however. Ogle had a patient who perspired to an extent throughout the disease. When so great a portion of the fluids excreted pass out by the urine, it is not strange that the skin should be indolent.

In the blood, as well as in every tissue and fluid of the body, sugar is found in abundance in Diabetes. Pavy thinks that the presence of sugar in the blood is the cause of the structural and functional disturbances in Diabetes, but he says, "In some cases there exists a source of interference with nutrition, beyond what can be accounted for by the mere presence of sugar in the blood" (Ogle). Prout states that the absence of injury from sugar in the blood "probably arises no less from its mild and innoxious character than from its great solubility in water." Fraser states that "more than five-tenths per cent. of sugar in the blood will give rise to Diabetes."

PART IV.

Although Hippocrates has not described the disease of Diabetes by name, he has recorded such symptoms of unnamed diseases, that many writers are induced to believe that this malady was not unknown to him. Galen was probably the first to call the disease by name, although from his own statement we may infer that the disease was known to his cotemporaries, if not to his predecessors. In the following passage, translated by Latham, Galen, speaking of Diabetes, says, "Here the kidneys seem to be affected with that very uncommon disease which some have called the dropsy into the chamber-pot, some the diarrhœa into urine, some the Diabetes, and some the dipsacus."

The next step in advance was made by Aretæus, who described the disease as "a colliquation of the flesh and limbs into urine" (Latham). So graphically does he describe the various symptoms of the disease that I would give his account in full would space permit. Speaking of the thirst of the diabetics, he says, "Should they awhile refrain from drinking, the mouth becomes dry, the frame parched, and the viscera seem to be on fire; . . . . overcome with nausea, distressed with perplexity; in no long time they die, so burning is their thirst. But what device can prevent the propensity to urine, or what sense of shame is superior to the painful

necessity? But if for a time they do possess the power of retaining it, they swell in the neighborhood of the loins, the privates and the hips; and when again they let it pass, they emit the urine with a scalding heat, and the swelling of the parts is removed, for the superabundant water is distributed into the bladder."

In another portion he thus refers to the origin of the name dipsacus: "For if a person be bitten by the dipsas, a similar affection arises from the wound. Now the dipsas, which is a serpent, if it bite any one, kindles an insatiable thirst; for then men drink abundantly, without effecting a cure for the thirst." Again: "Some, indeed, do not emit their urine, neither is there any other vent for the liquid imbibed; therefore from the continued desire of drinking and the superabundance of liquid and the distension of the belly, they quickly burst asunder."

It is undoubtedly due to Willis that, in the year 1684, the presence of sweetness in diabetic urine was made known. Speaking of the urine he says, "Why it should be so wonderfully sweet, like sugar or honey, is a difficulty not easy to be explained." Matthew Dobson, of Liverpool, in the year 1799, was the first to show by experiment that this sweetness was produced by sugar. Sydenham, Cullen, Baillie, Rollo and Venables, by adding their portion, unite the ancient with the more modern account of Diabetes.

In most instances Diabetes is chronic in its character, lasting for a number of years; but in a few cases the disease terminates rapidly. Galen says, "As the nature of this disease is chronic, it is generated by length of time; but short is the life of man when its establishment is once compleated"

(Latham). "Becquerel mentions the case of a boy of nine years who died in six days" (Roberts). The disease, according to Griesinger, usually lasts from two to three years; yet he mentions one case in which the disease was of eight years' duration. Bence Jones mentions the case of one of his patients who "had been diabetic for twenty-nine years, during which time he married, and has now healthy children." Cases in which the disease appears only at intervals are not infrequent. Usually Diabetes passes through its course with regularity, terminating in some one of its usual complications. Cases of sudden death in Diabetes have been recorded. Roberts says, "One of my patients fell back dead while eating his dinner."

The earliest complications with which we meet in Diabetes are affections of the skin, consisting of pustules, boils, or carbuncles. Dr. Jordao refers to the slight subepidermic hemorrhages, which are noticed chiefly in the hands and arms, appearing in the form of small, isolated, rose-colored spots, two or three millemeters in diameter, in which there are varicose vessels, surrounded by extravasated blood.

Mental derangement, in some one or other of its forms, is a very constant attendant on Diabetes. Persons whose temper, previous to the disease, was of the most amiable character, become now morose and fretful, the powers of memory seem to flag, and a drowsiness more or less marked troubles them. Marked cases of softening of the brain are on record. Ogle has come to the conclusion "that there are cases in which brain lesion may follow in the train of Diabetes and grow out of it, being in no wise antecedent to or the cause of it."

The eyes of a diabetic often have a preternaturally glassy look, and a dimness of vision is not an unusual occurrence. Roberts thinks that this dimness is owing to an atrophy of the retina. Where Diabetes has existed for a length of time, it may be complicated by cataract. Bence Jones says "there is no special complication belonging to Diabetes, unless it be cataract." Richardson, in his paper on the "Synthesis of Cataract," gives the result of his experiments with various substances, injecting them into the blood of animals to produce cataract: he made use of cane, milk, and grape sugar, mannite, liquorice, diabetic urine, glycerine alcohol, ammonium, soda and potassa; and he found that in order to produce the condition of cataract, the specific gravity of the fluid injected should exceed the specific gravity of the blood (1.055), and that as long as the blood remained in the abnormal state, so long the cataract lasted.

Of the substances which he injected, Richardson found that the sugars produced a "large, soft and pearly-white" cataract, salines "one rather shrunken and firm in structure, but of the same whiteness." "Amongst the salines, the chlorides act most energetically, after these the sulphates." Cataract occurs in Diabetes, according to Griesinger, once in eleven cases; others place the proportion as one in five, or one in thirty-eight. "We must look for diabetic cataract," says Richardson, "in cases where, with the existence of sugar in excess in the economy, the outward sign of the diseased condition is deficient or absent."

Spontaneous gangrene, allied to that occurring in old persons, now and then makes its appearance. Trousseau thinks that it may be due to the obliteration of the small arterial

branches, or of the larger trunks. It is thought by some to be caused by excessive drinking of alcoholic liquors, by others to be a disease of the arterial coats. I have been able to find seventeen cases of diabetic gangrene, but with them no satisfactory explanation.

The most common of the fatal complications of Diabetes is some pulmonary complaint. Roberts says that this trouble "affects nearly one half the cases protracted to the third year." There is a difference of opinion as to whether the affection is tubercular or not; Pavy and Wilks thinking that it is not true phthisis, but allied to it; while Griesinger, in sixty-four autopsies, found tubercle in thirty-one.

The tendency which there is in Diabetes to inflammation in the tissues, will account, to a great extent, for the various complications.

PART V.

So little, if any, knowledge of the nature of Diabetes is gained by a post mortem examination that it might seem useless to describe any morbid changes that present themselves on inspection; yet, as Diabetes is so intimately connected with other diseases, the morbid changes which the various organs undergo may, in the course of time, give an insight into the seat of the malady, and cannot be fairly overlooked. In whatever light the older writers on Diabetes regarded its morbid anatomy, modern research, by the naked eye, or by the most careful examination with the microscope, has not yet succeeded in discovering any characteristic morbid appearances whatsoever. In not a few cases the post mortem examination reveals nothing abnormal in any organ; in other instances disease appears in the organs according to the complication.

Our knowledge of the formation of sugar by the liver would naturally lead us to suspect a morbid condition of that viscus in Diabetes; but this is so far from being the fact, that in most cases the liver has undergone no perceptible change at all: in some cases it is found enlarged, and of a darker color than usual; in others, atrophied and of a yellowish red color. "Wilks believes that the diabetic liver presents differences to the eye which enable it to be distin-

guished from others: it is firm, tough, homogeneous or uniform in its appearance, and dark in color" (Roberts). That the liver is usually hard and firm in Diabetes is, I think, generally conceded; but at the same time the majority of writers on this subject deny the existence of a characteristic morbid appearance in the diabetic liver, or in any other organ. As to the presence or absence of fat in the cells, microscopical examinations have been contradictory; some observers, as Beale and Frerichs, finding a diminution of fat; while others, such as Pavy and Förster, found the fat undiminished.

The changes most frequently noticed in the kidneys, are enlargement and a certain flabbiness; sometimes cysts and cicatrices are met with. Prout says, "a section exposed to air gives in some cases a peculiar orange red tint." The enlargement is probably due to the increased amount of work which the kidneys have to perform, while the flaccidity may be accounted for by the tissue being kept on the stretch and thus losing its tone, just as the uterus, after a certain form of service, becomes shapeless and flabby.

From an extreme case of those given below, the enlargement of the kidneys will be seen to have reached (together) fifteen ounces; the usual weight singly being, according to Sharpey and Quain, four and a half ounces, the left being one-sixth of an ounce heavier than the right. The alteration of the kidney, whether in size or in other respects, differs according to the duration of the disease, there being little change at the most.

In nearly one half of those who die of Diabetes, some trouble, more or less serious, is found in the lungs. The lesion closely resembles tubercle, but there is a difference of

opinion as to whether it is really tubercle or not. Wilks, in his "Lectures on Pathology," says, "the lung mischief, attendant on Diabetes, is not of a tubercular nature, but the result of simple inflammation, owing to a depressed state of the constitution"; he also states that he has only once seen tubercle in Diabetes, once gangrene of the lungs. Willet says, "I think it also very difficult to state whether the suppurative condition arises from tubercle or chronic pneumonia, as on feeling very carefully over both lungs I could not trace a single hard substance between my fingers." Fraser thinks that the lung lesion is not tubercular. Besides the breaking down of the lung tissue from chronic inflammation, pneumonic consolidation and gangrene, with or without fœtor, at times occur.

Of late years, the morbid appearances of the brain and nerves have been the especial object of interest in the post mortem examinations of diabetics, owing to the connection thought to exist between Diabetes and nervous disturbances. The symptoms of cerebral disease in the last stages of Diabetes are often noticed.

As Diabetes has been produced by pricking the mesial line of the floor of the fourth ventricle, in the centre of the space between the auditory and pneumogastric nerves, the examination of that portion of the brain is made with some curiosity as to the result. Flint and Roberts both state that the floor of the fourth ventricle has presented morbid appearances in Diabetes. "Tardieu records a case of Diabetes in which there existed slight paralysis of the left side for three months; the Diabetes persisted until death, two years afterwards, from phthisis; the medulla oblongata was found

congested, and of a dark grey color" (Fraser). An ossific growth pressing upon the pons varolii and abscess in the posterior cerebral lobes have been found by Dr. Richardson.

The arteries of the affected portion of the brain are often found plugged up. Ogle thinks that this is due to the softening of the brain, which, breaking down the tissues of the arteries, is the cause of their occlusion; he says "The diabetic state stands in relation of cause to the deterioration or dilapidation of the brain, and this, in its turn, as the cause of the occlusion of the arteries."

In a patient of Venables, the following morbid appearances of the spinal cord were found: "A degree of low inflammation seemed to have pervaded a considerable portion of the column both above and below the excavated part, as several flakes of coagulated lymph were found deposited upon the marrow and internal surface of the theca, or sheath, which was itself inflamed in several spots."

Further researches, it is evident, are necessary to prove anything with regard to the seat of Diabetes; at present, all that can be said is that there is nothing known of it from the morbid appearances of the organs.

From fourteen cases of fatal Diabetes, taken from the report of Ogle, I have copied the accounts of the post mortem examinations, thinking that, being reports correctly taken, they would best illustrate the variety of morbid lesions found in the disease.

I.

Pleural adhesion; tubercular deposits with vomicæ in the lungs; heart pale and softish; liver large and nutmeggy; one kidney large, pale and mottled, the other atrophied with several calculi, two of

which were involved in a false membrane in the pelvis of the organ.

II.

Heart softened; purulent deposits in knee joint and below the fasciæ and in the rectus muscle of one leg; also beneath the mucous membrane of the larynx; kidneys congested.

III.

Thirty-four hours after death (winter); organs so putrified that it could hardly be ascertained what state they were in.

IV.

Slight pleural adhesions; patches of scrofulous matter were infiltrated in the left lung; no tubercular masses; upper lobe of right lung almost converted into a large, foul, sloughy cavity; kidneys coarse.

V.

The upper part of the lobe (lower) of the left lung changed to an abscess, the surrounding parts being hepatized; upper lobe of right lung contained several patches of tubercles; lower part a smaller abscess; kidneys congested and coarse.

VI.

Both lungs contained much scrofulous deposit and several vomicæ; kidneys ten ounces weight, cortex narrow, and with few cysts; cortices open and pelvis injected and red.

VII.

Lower parts of both lungs containing patches of a dark brown reddish color, easily broken, and giving out a grey fluid; kidneys large; cortices of a light fawn color; tubes containing much gran-

ular and fatty matter; stomach lining much ecchymosed; slight subarachnoid fluid.

VIII.

Lower part of left lung much hepatized, the gray form predominating; liver large, rounded and fatty; kidneys granular and containing cysts; much subarachnoid fluid.

IX.

Vessels of the brain congested; liver fatty; kidneys coarse and congested.

X.

Scrofulous tubercles and vomicæ found in both lungs; much fibrin on the pleura of right lung; kidneys large, thirteen and one half ounces, lobulated with congested cortices.

XI.

Lungs tuberculous; vomica in upper part of the right lung, lower part infiltrated with a grayish fluid; liver and kidneys natural; suprarenal capsules both finely mottled with an appearance like that of liver, each with a small patch of fibrinous material in the centre.

XII.

Lungs congested posteriorly; kidneys coarse, weighing fifteen ounces.

XIII.

Lungs congested; heart soft and fatty; liver (nine pounds two ounces) hard, yellow and granular on surface; deep clay color on section; gall bladder containing a number of small black gall stones; kidneys softer than usual; mucous folds of the stomach thickened.

XIV.

The fourth ventricle was the seat of a finely granular deposit; central part of pons seemed rather more vascular than usual; one hard tubercle the size of a pea in apex of right lung; liver pale and fatty; kidneys twelve ounces, soft, flabby, and smooth; cortical parts large, and the tubules full of epithelium; no œdema.

From the above cases we find that in ten of the fourteen there was lung trouble; in twelve cases there was some lesion of the kidney, either congestion, hypertrophy, or atrophy; one case of calculi, two of cysts; in four cases there was more or less lesion of the brain; in four cases affections of the liver. These cases, though few in number, may be enough to illustrate the general proportion of the various lesions: first those of the lung, next of the kidney, next of the liver, and lastly of the brain.

PART VI.

The glycogenic function of the liver, discovered by Bernard in 1848, has given rise to various speculations with regard to the true nature and seat of Diabetes. Still later the same physiologist found that certain injuries of the nervous system would produce sugar, for a greater or less time, in the urine: from this last discovery, and from the mental disturbance noticed in diabetics, the disease has been classed by many as a nervous one.

It may not be uninteresting to review, briefly, the theories of certain authors with regard to this disease.

Galen thought that the urine was strained from the vena cava into the kidneys, by a certain disposition on the part of these organs, and he defines Diabetes to be "a peculiar affection of the kidneys themselves, analogous to the canine appetite at the orifice of the stomach, with atony of the retentive power" (Latham). Willis says, "I conclude that Diabetes is rather and more immediately an affection of the blood than of the kidneys, and that it thence has its origin, inasmuch as the mass of blood becomes, as it were, melted down, and is too copiously dissolved into a state of serosity; which indeed is very manifest from the quantity of urine so immensely increased, which cannot have arisen from any other cause than from this solution and waste of the blood."

Baillie concluded "from the morbid appearances in the

kidneys that the disease was in them." Rollo says "the proximate cause of Diabetes mellitus seems to us to consist in a morbidly increased action of the stomach with consequent secretion and irritation of the gastric juice, marked by an eagerness of appetite and acidity." Venables, "I am inclined to consider the kidneys as the seat of the disease."

Flint thinks that Diabetes "clearly depends on an undue introduction or a deficient destruction of sugar, or both combined." Bernard, "that it is due to the hyper-secretion of sugar by the liver, dependent on morbid excitation received through the nervous system" (Flint). Von Durch, that "it depends on the sugar normally existing in the blood being undestroyed and unappropriated" (Fraser). Bouchardat, that "the disease consists in a measure in an abnormal production of sugar from the ingesta within the alimentary canal, and that this is proved by excluding all ingesta, such as are readily converted into sugar, when the notable effect of the decrease of sugar is observed (Flint). Frerichs, "It arises from the arrested metamorphosis of the sugar formed in the liver."

Carter says, "I am inclined to the physiological theory of M. Bernard, to ascribe the primary cause of the disease to a deficiency of nervous power, from some morbid impression at or about the origin of the pneumogastric nerves." Bence Jones thinks that "Diabetes must be considered as an exaggeration of a healthy state, and not as a distinct and peculiar condition of the system."

The results of Bernard's experiments in producing Diabetes by injuries inflicted on the nerves, spinal cord or brain, have led many to regard Diabetes as the result of

the lesion of some portion or other of the nervous system. Now as every disease has certain symptoms which can be referred to a deficiency of nervous power, we are apt to give up to nerve disease those symptoms which are otherwise inexplicable, and in the comparative obscurity in which diseases of the nerves are wrapped, the recourse is a convenient one. Yet, as Bence Jones says, "he would be but a poor physician who overlooked the influence of the nervous system, either in the origin, the progress or the treatment of every disease."

PART VII.

Diabetes mellitus is not a difficult disease to diagnosticate. If sugar is present in the urine, persistently and in large quantities, it is enough to determine the disease; the other symptoms by themselves are of no great value. Fraser states that "great thirst and great appetite are rarely, if ever, conjoined in other diseases."

The prognosis depends upon the advance which the disease has made upon the patient, and upon the complications which may intervene during its course. Where the patient has been affected with the disease for a length of time, the prognosis is very unfavorable, unless no complications appear, and there is little general debility, which is seldom the case. In attacks of what have been called temporary glycosuria, the patients have every chance of recovery; of the complications, the affections of the lungs are the most likely to prove fatal, and are recovered from with the most difficulty; "the existence of cataract is a very unfavorable indication" (Roberts). As a general rule, the younger the patient the more unfavorable the prognosis. The obese class of diabetics, mentioned by Prout, seem to have a better chance of recovery than those who are naturally thin. As to the effect of treatment on the prognosis, Roberts says "it must be remembered that when by treatment the disease has been brought apparently to a stand-still, a diabetic patient still holds his life by a very frail tenure."

PART VIII.

If we examine the chemistry, as it were, of Diabetes, we shall be more rationally guided in our treatment; we know that when starch is taken into the system it becomes changed into sugar through the action of the saliva and the pancreatic fluid; it then serves to nourish and give power to the body, and in the end is eliminated as water and carbonic acid.

This same change of starch into sugar goes on in Diabetes, but the power of transformation into carbonic acid and water is wanting; the sugar then accumulates as such in the system, and in the attempt which nature makes to free itself, every fluid and tissue of the body becomes charged with it, a part remaining in the blood, a part being excreted by the urine. This want of conversion of sugar into carbonic acid and water, is the means of depriving the system of its proper nutrition, and accounts to some extent for the inanition observed in diabetics.

Bence Jones states that the conditions by which the sugar is changed into carbonic acid, are as follows:—

I. The proper temperature.

II. The presence of a not immoderate quantity of sugar.

III. The presence and activity of the proper ferment.

What the proper temperature should be for this change to go on within the body, is not yet determined; but by ex-

periments it has been found that the internal temperature of the body varies very slightly under different circumstances. Should there be too much sugar present, the change will not take place; this is known by the fact, that when saccharine food is taken into the system in abundance, a kind of temporary Diabetes ensues.

Bence Jones states that "the ferment, the prime cause of change, has not been yet insulated. Whether it be the albuminous substance of the saliva, or pancreatic fluid, or some other of the many albuminous substances in the blood, it requires for its action, heat, the presence of an alkali, and an undisturbed circulation of the changing fluid."

In mild forms of Diabetes there is a want of power to change, the food-sugar into carbonic acid; in persistent forms there is a want of power to change both the food-sugar (the starch, etc.) and the tissue-sugar (inosite) of the body. We can see from this the reason why the mild forms of Diabetes are easier to treat successfully than the persistent forms, for in the one we have but a single obstacle to combat with, in the other, two. We can understand also why the treatment, by excluding all sugar-producing substances from the food, has been successful in so many cases.

What treatment then is indicated in Diabetes? Treatment through drugs, through diet, and through exercise.

Knowing that almost every drug in the Materia Medica has been tried and found wanting, as far as a permanent amelioration of the symptoms of Diabetes is concerned, we cannot expect much service from them; yet the assistance which they do give should not be discarded. Drugs may aid in producing the oxidation of sugar, and in building up the general health, which the loss of oxidation impairs.

In the first place to produce oxidation. The various preparations of iron, the sesquichloride, phosphate, iodide, ammonio citrate, and many others, are of use ; in these we have a means of improving the quality of the blood when it becomes impoverished by disease. The manner in which iron serves to promote oxidation, can only be understood by examining its physiological action in the system. Bence Jones traces this action out as follows:—

When a soluble salt of iron is taken, in a few hours a part of it is changed into a sulphuret, or is reduced to an oxide in the bowels, and losing its solubility and power of diffusion, is thrown off as useless. Another part, escaping precipitation, remains dissolved, and passes, in from seven to ten minutes, if the stomach is empty, into the urine, where it may be detected partly oxidized. A third part "diffuses from the liquor sanguinis into every texture, and into the blood globules and white corpuscles, making a greater formation of hæmoglobin and thereby promoting that combination with protagon (C_{116} H_{241} N_4 O_2 P) on which the production of new blood globules depends." These globules, together with the fibrin, meeting the oxygen of the air transmitted through the membrane of the air vesicles, "appropriate the incoming oxygen and carry it to the capillaries whence it must diffuse into each structure to support the oxidation which takes place everywhere."

The more iron then we absorb, the more globules we form, and the more oxygen is taken into the capillaries; we should bear in mind that there is often a deficiency of nervous power which prevents the combination of iron with the blood.

Another means of promoting oxidation is through alkalies. On this point Bence Jones says, "The alkali disturbs the equilibrium of the elements in the organic body, by its affinity for acids. Aided by oxygen and heat, more or less complex acids are formed from the neutral substances, and if the action of the alkali is sufficiently continued, carbonic acid, water and ammonia alone remain." Such alkalies as the carbonates of soda and ammonia, potassa, lime and magnesia ; and such alkaline drinks as Vichy, Carlsbad Sprudel, Seltzer and soda waters, may be used to advantage.[1]

Many other substances, such as chlorine, iodine, salts of zinc, copper, antimony, mercury, croton and castor oils, elaterium, aloes and jalap promote oxidation in the system ; but we should remember, in giving them, that the caustic alkalies are greater promoters of oxidation than the sub-carbonates, and the carbonates than the bicarbonates. Counter-irritation by friction or by external applications to produce heat, especially by electricity, are also useful in promoting oxidation.

The second indication which drugs have to fulfil is in the building up of the general health ; this may be brought about by the use of tonics, such as quinine, gentiana, manganese ; the various tonic acids ; vegetable and animal oils and fats, such as cod liver oil, sweet oil, glycerine and cream have been used with good results ; the use of cream, how-

[1] "The use of acid drinks, and especially dilute phosphoric acid, has been highly spoken of in some quarters. Griesinger reports unfavorably of their effects. He pushed dilute phosphoric acid to the extent of an ounce daily. At first, and under the smaller doses, the patient seemed to do very well; but after ten days, and with the full quantity, the volume of urine and the proportion of sugar slightly increased, and the general state of the patient grew worse. I have frequently employed bitartrate of potash water for the purpose of allaying thirst, with good effect" (Roberts).

ever, is not possible after the tongue becomes coated, for it then becomes nauseating to the patient and is rejected ; many patients are nauseated with fats or oils of any kind.

Still another use of drugs in Diabetes is to relieve the constipation by gentle purgatives, such as castor oil, colocynth or Seidlitz powders: as a general rule saline cathartics which are of such use in other diseases should be avoided in Diabetes, as they increase the thirst of the patient. This desire for drinks, as well as the excessive appetite, may be relieved by opium given in small quantities (5-10 grains of Dover's powders once or twice a day). Roberts says, "If no restriction be placed on the diet, opium in doses of from six to twenty grains a day has always in my experience had the power of reducing the flow of urine by about one half . . . and this without increasing its density." Opium has also its advantages in freeing the patient from the irritability of temper and despondency which the disease brings with it. To assist the skin in recovering its healthy action diaphoretics may be used.[1]

Let us now pass to the consideration of the treatment by blood-letting, sinapisms and setons ; as to blood-letting, we are told by Druitt that, "by diminishing the mass of blood, it lessens the labor of the heart and lungs, and allows the remaining blood to be oxygenated and purified by natural influences." On the other hand, by diminishing the quantity of blood, we diminish the means which the system has of oxidation, for the number of corpuscles becomes less, and

[1] "The patient should be clad from head to foot in flannel, in order to encourage the action of the skin, and defend the patient from the chilly sensations so common in this complaint. A warm bath once or twice a week is also very grateful to the patient, and abates the harsh, arid condition of the skin" (Roberts).

the body is deprived of its nutrition in proportion to the amount of blood taken away.

It would seem then as if blood-letting were contra-indicated in Diabetes, yet Venables stated that he knew by experience that blood-letting considerably diminished the discharges of urine in Diabetes, and he quotes a diabetic case of Dr. Watts's, in which, by repeated venesections, one hundred and eighty ounces of blood were drawn off, the patient's health being perfectly restored. The emaciation and debility almost always present in Diabetes would I think, contra-indicate blood-letting.

The use of sinapisms has been thought by some to be productive of good results; the pain and tenderness in the loins has been relieved by their application, and, if an ulcerated and discharging surface be produced, the symptoms of Diabetes seem to be ameliorated in some cases. Kunkler relates the case of a patient who had had Diabetes for seven months, and who, in spite of animal diet and various remedies, got worse; there were several tender spots in the upper part of the dorsal region of the spine, which disappeared on cupping; the disease, however, being unchanged. Immediately after a blister to the neck, the presence of sugar and the unusual excretion of urine ceased, as if by enchantment. By a repetition of the blisters, the Diabetes permanently disappeared, notwithstanding the varied diet.[1] Dr. Buttura mentions the only case that I could find of permanent cure by the introduction of a seton into the neck.

Treatment by diet is next to occupy our attention. Bence Jones says of it, "The effect of diet is far beyond that of

[1] Year Book of Medicine and Surgery, 1862.

any known remedy." What do we wish to obtain by a restricted diet? We wish to prevent the introduction of sugar by food into the system, so that, should the disease depend upon the inability to assimilate and oxidize the food-sugar alone, we could treat it more successfully than if no attention whatever were paid to the diet. On the one hand, G. Owen Rees says, in regard to diet, "What I venture to insist on is this, that they (the diabetics) do better on a natural diet; that saccharine and farinaceous food is necessary to the comfort and well-being of the diabetic as it is to the healthy stomach; that abstinence from starchy and saccharine matter is injurious to the diabetic, and that the circulation of sugar in the blood is not productive of bad symptoms either immediately or remotely." [1]

Goolding on this point says, "The appetite and thirst are to be considered as natural indications, to be gratified with prudence, and more with reference to the wants of the system, than any fear of increasing either the sugar or the amount of fluid." [2]

Signor Burresi, of Siena, has maintained the use of a saccharine diet, as a change after one exclusively animal; and thinks that although the benefit derived from it is attended with much uncertainty, in some cases the relief is both speedy and continuous; indeed he thinks that a release from the monotony of animal food alone is highly desirable. [3] On the other hand, Aitken observes, "It is necessary to abstain from all amylaceous food, as well as from every solid and liquid containing sugar, or any substance directly convertible into sugar." Abbotts

[1] *Lancet* July, 17, 1866.
[2] *Lancet*, July 15, 1854.
[3] *Medical and Chirugical Review*, Vol. XXXVII.

Smith says, "The first point to be attended to in Diabetes is the diet, from which all saccharine and amylaceous substances should be rigorously excluded."

It is a disputed point among many as to whether an anti-farinaceous diet is a natural one or not; it seems that, if we consider for a moment that the Laplanders and Patagonians, and many other people, subsist on an exclusively animal diet, and yet live in perfect health, the saying that "bread is the staff of life" is proved a fallacious one, and that the question is once and for all settled. Diet is rather a slave to custom than to nature; and where persons have been brought up to live on both animal and vegetable food, it is not strange that the deprivation of one or the other should have a marked effect on them.

The effect of a restricted diet is to diminish the quantity of sugar in the urine to a great extent, if not altogether. By this diminution of sugar excreted, in the majority of cases, the symptoms are ameliorated, and the system, taking a rest, as it were, is placed upon the road to improvement. Great care should be taken to vary the food which the diabetic has to take; for if one kind of food is continued for a length of time, the patient has such a loathing for it that it has to be eliminated from his list of eatables.

In general all kinds of animal food may be taken, and all sorts of vegetable food should be avoided. There are exceptions, however, for in the list of vegetables, lettuce, cabbage, cauliflower, watercresses and asparagus tops may be allowed; some vegetable substances, too, are more productive of sugar than others; and when vegetables must be given, on account of the ill symptoms which a total deprivation of them now

and then causes, it may be well to know which we may select. The following table, taken from the "Lectures on Pathology and Therapeutics," by Bence Jones, shows the amount per cent. of dextrine, sugar or starch, in various vegetable substances and in liquids: —

DEXTRINE, SUGAR OR STARCH.

Apricots,	93 per cent.	Figs,	79 per cent.	Potatoes,	76 per cent.
Plums,	92 "	Gooseberries,	37 "	Oat meal,	70 "
Peaches,	86 "	Dry rice,	90 "	Peas,	67 "
Cherries,	85 "	Maize,	88 "	Beans,	67 "
Pears,	84 "	Arrowroot,	77 "	Bread,	61 "

GRAINS OF SUGAR TO THE OUNCE.

Stout,	45–64.	Sweet cider,	18–44.	Champagne,	6–28.
Porter,	23–40.	Port,	16–34.	Sherry,	4–18.
Bitter ale,	12–130.	Madeira,	6–20.	Cyprus,	102.

Cow's milk contains 4.7 per cent.

We see from this list that common bread contains about sixty-one parts of sugar-producing substance; now as diabetics have an intense desire to eat bread, it has been an object to contrive a substitute which shall be palatable, and yet free from injurious qualities. Such bread has been prepared by Camplin, who, using simply wheat bran very carefully washed and finely ground, and mixing with it butter, eggs and milk, with seasoning of spice to the taste, has succeeded in making a palatable article of food. Pavy has made bread from the powder of finely-ground almonds; and Bouchardat has prepared what is called "gluten bread," by washing all the starch from the wheat flour. When the patient is unable to bear either of these preparations, Roberts mentions the use of thin slices of ordinary bread, well toasted before the fire.

Although from the above list milk might seem to be injurious, it has been shown by experiment, "that this sugar is

often partly or entirely consumed." Again, "Milk is more or less injurious according to the stage of the complaint. When animal sugar can be consumed, milk is comparatively harmless" (Bence Jones). Chambers mentions the fact that the Circassians never drink milk uncooked, but always boil it, mixing with it some alkaline substance by which it is rendered more digestible. All kinds of fish may be eaten freely, and form a pleasant change of food in many cases. If also we regard Diabetes as the result of a deficient nervous power, the phosphorus supplied by fish may be a means of making up that deficiency.

Bence Jones has quoted the elaborate bill of fare for diabetics of M. Bouchardat. It is too ample to give in full, but from it I have taken certain articles which, with those already familiar, will serve to point out in a degree the diet of the diabetic patient.

Bread. — Bran bread, gluten bread, almond bread, torrified bread.

Soups. — Broths, meat soups, cabbage soup, poached egg soup, game soup.

Side Dishes. — Fresh eggs, sausages, pickled pork, black pudding, ham, pigs' feet, dried herrings, oysters on shell.

Fish. — All kinds of fresh and salt water fish, also lobster, crawfish, crabs and prawns.

Meats. — Boiled beef, roast beef, minced beef, beefsteaks, leg of lamb, larded lamb, fricassee of lamb, mutton chops, sweetbreads, fricasee of veal, calves' head, veal cutlets, turkey, chicken, duck, pigeon.

Game. — Partridge, venison, woodcock, snipe, quail, teal, plover.

Vegetables. — Artichokes, cauliflower, cabbage, asparagus, cucumbers, water-cress, lettuce.

Drinks. — Vichy with claret, Carlsbad Sprudel, soda water, cream, tea and coffee without sugar but with glycerine.

Dessert. — Neufchatel cheese.

The treatment of Diabetes by forced exercise is strongly advocated by Bouchardat, Trousseau and others. Let us see on what principles exercise may be of use. First, as to oxidation ; in speaking of the mechanical treatment of diseases, Bence Jones says, "Motion in two ways increases chemical action, first directly, by conversion of force, and second indirectly, by bringing the molecules more closely into contact, so that the latent energy can be changed into active force. This is chiefly effected by the circulation bringing fresh and larger amounts of oxygen in contact with the hydrogen and carbon, phosphorus and sulphur of the textures." Rest on the other hand directly hinders oxidation, by diminishing the chemical action of the tissues.

On this point Abbotts Smith, without doubt thinking of the suddenly fatal terminations of Diabetes, says, "Patients therefore, in the confirmed stages of Diabetes, should be cautioned against taking long journeys or otherwise fatiguing themselves, particularly in very cold or in very hot weather." Thudichum, in speaking of some of the causes of sugar in the urine, says, by "perfect rest in bed sugar becomes less in quantity, and disappears for a day or two ; it reappears as before on the patient taking exercise."

Secondly ; by exercise we restore in a measure, healthy action to the skin. Sir Henry Marsh states that " no remedy is of use until the skin relaxes and sweat begins to appear on the surface."

Thirdly ; constipation, one of the early and frequent symp-

toms in Diabetes, is seldom if ever radically cured by drugs; exercise and diet are generally acknowledged to be the only methods of affording permanent relief.

It is not intended that by forced exercise a patient shall be obliged to exert himself to a greater degree than his strength will allow, but that, by doing a little one day, and a little more the next, and so on, the patient may gain strength by degrees. This treatment of Diabetes is not one of recent date. Latham speaks of its efficacy in the following case in which the patient, "weary of life and destitute of every ray of hope, had wandered about as well as his strength would allow him for a few days among his fellow-laborers of the neighborhood, and finding from this exertion that his strength did not decrease was tempted to take part in the work that was going forwards; (that) a copious perspiration very soon ensued under which he did not feel himself weakened in bodily powers but rather improved in spirits; (that) he renewed the same sort of easy occupation from day to day with the same comfortable event, and that at last not only his spirits but his bodily strength was manifestly increased; his urine, however, was then neither perfectly natural in smell or taste or quantity, although in all these respects it was certainly much amended." From the subsequent circumstances of the case Latham concluded that the patient was cured.

Bouchardat's treatment is on this very principle. In the case of one of his patients he required him to work for a short time (a minute or less) at first, with a shovel in a garden. The first time the patient fell down quite exhausted; but day by day there was evident improvement in his strength,

until finally his health was quite restored. In speaking of exercise, Bouchardat says: "La gymnastique doit être préférée avant tout; mais il importe de prendre certaines précautions. Quand les exercises ont été continués pendant une heure et que le corps est inondé de sueur, il faut changer de flanelle, se laver vivement avec des linges, imbibés d'eau froide, puis se frictionner avec de gros linges; enfin se masser afin d'obtenir une réaction complète que l'on sontiendra par une marche d'un quart d'heure au moins, le corps étant protégé par de bons vêtements en laine."

Trousseau also to this effect says: "Un diabétic qui, chaque jour, fait à pied un exercise violent, peut sans rien modifier à son régime récupérer temporairement la santé qu'il avait perdue. Jai connu des glycosuriques qui au moment des chasses, cessaient de boire et d'uriner avec autant d'abondance, retrouvaient leurs forces, leur appetit; récupéraient, malgré les fatigues, leurs facultés viriles perdues depuis le début de la maladie."

Bence Jones mentions several cases in which the patients were so prostrated, by even short journeys, that they died in consequence. This is not inconsistent, however, with the theory of exercise in Diabetes, for sudden and too great exercise all would acknowledge an injury, but in a gradual and slight exercise very many are discovering a benefit.

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